NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

RECRUITER AND RECRUIT MATCH: THE EFFECT OF GENDER AND RACE MATCH OR MISMATCH ON THE QUALITY OF RECRUITS

by

Jason Gay Taur Oh

December 2013

Thesis Co-Advisors: Jesse M. Cunha
                                                         Jeremy Arkes

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE		*Form Approved OMB No. 0704-0188*

1. AGENCY USE ONLY *(Leave blank)*	**2. REPORT DATE** December 2013	**3. REPORT TYPE AND DATES COVERED** Master's Thesis

4. TITLE AND SUBTITLE RECRUITER AND RECRUIT MATCH: THE EFFECT OF GENDER AND RACE MATCH OR MISMATCH ON THE QUALITY OF RECRUITS	**5. FUNDING NUMBERS**
6. AUTHOR(S) Jason Gay Taur Oh	

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000	**8. PERFORMING ORGANIZATION REPORT NUMBER**

9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A	**10. SPONSORING/MONITORING AGENCY REPORT NUMBER**

11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government. IRB protocol number NPS.2013.0001-CR01-EP5-A.

12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited	**12b. DISTRIBUTION CODE** A

13. ABSTRACT (maximum 200 words)

This study explores how the match or mismatch between recruiters and recruits in terms of gender and race/ethnicity is associated with various measures of the quality of recruits. Specifically, amongst recruits of a similar race/ethnicity and/or gender, we compare across recruiters, by race/ethnicity and by gender, AFQT scores, and the likelihood of Delayed Entry Program attrition and attrition at various points in the career.

Personnel data on the universe of Navy recruiters and recruits over the past 15 years is used. The findings suggest that while there is a statistically significant effect of the gender match on the quality of recruits, it is very small in economic terms. On the other hand, there is an economically (and statistically) large effect of the racial/ethnic match or mismatch on the quality of recruits. In particular, Hispanic and Black recruits recruited by recruiters of the same race/ethnicity have lower AFQT scores as well as lower probability of being a Category A recruit. Furthermore, the recruits signed by Hispanic recruiters (within each racial/ethnic group) are less likely to attrite in the first year of service. As recruiters may not be randomly assigned to recruiting populations, it is impossible to determine whether these associations are reflecting a causal or correlational relationship, a fact which must be known in order to use these findings for policy purposes.

14. SUBJECT TERMS Navy Recruiting Command, Navy Recruiters, Quality of Navy Recruits, Gender Interaction Effect, Racial/Ethnic Interaction Effect, Armed Forces Qualification Test (AFQT) scores, Category A, Delayed Entry Program (DEP) Attrition, Attrition	**15. NUMBER OF PAGES** 69
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT Unclassified	**18. SECURITY CLASSIFICATION OF THIS PAGE** Unclassified	**19. SECURITY CLASSIFICATION OF ABSTRACT** Unclassified	**20. LIMITATION OF ABSTRACT** UU

i

THIS PAGE INTENTIONALLY LEFT BLANK

RECRUITER AND RECRUIT MATCH: THE EFFECT OF GENDER AND RACE MATCH OR MISMATCH ON THE QUALITY OF RECRUITS

Jason Gay Taur Oh
Civilian, Ministry of Defence, Singapore
B.Sc., National University of Singapore, 2005

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

**NAVAL POSTGRADUATE SCHOOL
December 2013**

Author: Jason Gay Taur Oh

Approved by: Jesse M. Cunha
                Thesis Co-Advisor

                Jeremy Arkes
                Thesis Co-Advisor

                William R. Gates
                Dean, Graduate School of Business and Public Policy

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

This study explores how the match or mismatch between recruiters and recruits in terms of gender and race/ethnicity is associated with various measures of the quality of recruits. Specifically, amongst recruits of a similar race/ethnicity and/or gender, we compare across recruiters, by race/ethnicity and by gender, AFQT scores, and the likelihood of Delayed Entry Program attrition and attrition at various points in the career.

Personnel data on the universe of Navy recruiters and recruits over the past 15 years is used. The findings suggest that while there is a statistically significant effect of the gender match on the quality of recruits, it is very small in economic terms. On the other hand, there is an economically (and statistically) large effect of the racial/ethnic match or mismatch on the quality of recruits. In particular, Hispanic and Black recruits recruited by recruiters of the same race/ethnicity have lower AFQT scores as well as lower probability of being a Category A recruit. Furthermore, the recruits signed by Hispanic recruiters (within each racial/ethnic group) are less likely to attrite in the first year of service. As recruiters may not be randomly assigned to recruiting populations, it is impossible to determine whether these associations are reflecting a causal or correlational relationship, a fact which must be known in order to use these findings for policy purposes.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF FIGURES

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

AFQT	Armed Services Qualification Test
ASVAB	Armed Services Vocational Aptitude Basis
DEP	Delayed Entry Program
DMDC	Defense Manpower Center
DoD	Department of Defense
FY	fiscal year
NRC	Navy Recruiting Command
OLS	ordinary least square
PRIDE	Personalized Recruiting for Immediate and Delayed Enlistment
ROTC	Reserve Officers' Training Corps

THIS PAGE INTENTIONALLY LEFT BLANK

ACKNOWLEDGMENTS

THIS PAGE INTENTIONALLY LEFT BLANK

I.   INTRODUCTION

A.   PURPOSE

Few studies have analyzed the effect of military recruiter selection and assignment on improving the productivity of those recruiters and the quality of recruits enlisted into service. Effective selection and assignment of recruiters is a cost-effective and resource-saving approach, which is relevant in today's economic climate, as the government needs to be financially prudent in their spending. The tightening of the defense budget and the trimming of the number of establishments in the military is a clear sign that financial resources are decreasing and any usage of those resources should be optimally utilized.

B.   RESEARCH QUESTIONS

This thesis examines whether there is an effect on the quality of recruits arising from the gender and racial/ethnic interaction of the recruiters and recruits. The interaction effects look at whether the quality of recruit will be different when there is a gender or racial/ethnic match between the recruiter and recruit as compared to a difference in the gender or race/ethnicity between the recruiter and recruit. This research contributes to that research on the Navy by Barfield (1993) and a study done by Dertouzos et al. (2006) on the Army.

The research questions to guide this analysis are as follows:

1.   What is the gender or racial/ethnic interaction effect between the Navy recruiters and the recruits that they enlist, and how does it affect the quality of the recruits?

2.   Does the effect of Navy recruiters' demographic variables on the quality of recruits vary by gender or race/ethnicity of the recruits?

A multivariate analysis is used to answer these research questions. The U.S. military personnel data from Defense Manpower Data Center (DMDC) and U.S. Navy's

Personalized Recruiting for Immediate and Delayed Enlistment (PRIDE) recruitment database is used to analyze the gender and racial/ethnic interaction effects.

The findings of this study are intended to establish some insights on this relationship to help Navy Recruiting Command (NRC) in their selection and assignment of new recruiters, to increase the success rate of enlisting potential applicants and improve the quality of these new recruits to meet the recruitment objectives of Navy.

While the assignment of recruiters is generally driven by the preferences of the recruiters and availability of vacancies in each recruiting station, there could be additional considerations used in assigning recruiters. For example, it makes sense to assign recruiters to their home state or recruiting area that shares their racial/ethnic background to achieve a better background match for recruiting purposes. These criteria are not in the assignment guidelines. Thus, this study aims to examine whether a recruiter and recruit matching in terms of gender or race/ethnicity could result in the enlistment of better quality recruits. This will be useful information for NRC to help them in the assignment of recruiters to achieve better quality recruits. This not only helps in achieving the manpower requirements of Navy but also translates to cost savings due to lower attrition rates and higher productivity in the workforce of the organization.

Enlisting better quality recruits not only improves the retention rates but also increases the caliber of the workforce and achieves better stability in the organization due to better job-to-person match. This is vital for the armed forces, as the military could not employ a mid-careerist to take on a managerial or senior position as the private sector can. Sailors need to be groomed from "the ground up" and be prepared to take on a leadership role. This takes considerable time and money, and if the wrong personnel are selected, they may choose not to re-enlist/extend their service or even resign abruptly halfway through their careers. This will disrupt the succession planning of senior leadership positions and reduce the return on investment in the resources spent to prepare personnel for future leadership role.

C. RESULTS

The findings on how the quality of recruits is associated with the gender and racial/ethnic interaction effects are as follows:

1. Gender Interaction Effect

There is statistical evidence to show that male recruiters are better at enlisting recruits with higher Armed Forces Qualification Test (AFQT) scores and have a higher probability of enlisting male recruits classified in Category A. On the other hand, female recruiters are better at enlisting male recruits with a lower probability of attrition during the first 12 months.

2. Racial/Ethnic Interaction Effect

There is no consistent result supporting positive outcomes in terms of enlisting better quality recruits arising from the same racial/ethnic interaction effect. Black recruiters are better at enlisting White recruits with higher AFQT scores and a higher probability of being classified in Category A at 15 percent significance level. Hispanic recruiters are better at enlisting Black recruits with higher AFQT scores and a higher probability of being classified in Category A at 1 percent significance level. White recruiters are better at enlisting Hispanic recruits with higher AFQT scores and a higher probability of being classified in Category A at 1 percent significance level. Conversely, the results show that Black recruiters and Hispanic recruiters did poorly in recruiting within their respective race/ethnicity as the recruits that they enlisted have the lowest AFQT score and probability of being in Category A at 1 percent significance level, as compared to White recruiters.

For the Delayed Entry Program (DEP) attrition, there is no significant statistical evidence that any particular race/ethnicity of recruiters enlisted recruits with lowest probability of DEP attrition. For attrition during the first term of service, there is significant statistical evidences to show that the Hispanic recruiters enlisted recruits with

the lowest probability of attrition at the end of 12 months for all three racial/ethnic categories of recruits, at the end of 24 months for Black and Hispanic recruits and at the end of 45 months for Hispanic recruits.

D. LITERATURE REVIEW

Most studies, such as Barfield (1993), Oken et al. (1997) and McGlocking (2013), that look at the productivity of Navy recruiters focus on the effectiveness of the award systems and how best to design and use these systems to meet the recruitment objectives of the Navy. While the awards system has a direct impact on recruiters' productivity, findings showed that it is not a perfect system as it looks at the total contracts signed instead of the quality of the recruits enlisted. What it means is that a recruiter could fill up empty billets with high quality recruits at the beginning of the month andm if the recruitment goals are not met by the end of the month, the recruiter may try to meet the monthly goals for the awards program by enlisting lower quality recruits. Thus, while the award system may improve the productivity of recruiters in terms of total number of contracts but may not have an impact on the actual quality of recruits enlisted into service. This can be seen in the findings in Arkes and Cunha (2013) on workplace goals and output quality. They find that there is a significant reduction in the quality of recruiters' enlistees towards the end of the contracting month.

Studies on how to improve the productivity of recruiters to enlist better quality recruits actually look at usage of external influencers or instruments to effect a change in the behaviors of recruiters. Not many studies have focused on the human resource management aspect in terms of selection and assignment of recruiters to specific recruiting stations or recruiting areas. This approach does not require any external influencers and incurs at a lower or minimal financial cost to implement when the resources and assignments are managed properly.

Part of the Barfield (1993) study examines the effect of the gender and racial/ethnic interaction between the recruiters and the recruits and the impact on the productivity of recruiters (in terms of the total number of contracts signed). She finds that recruiters are more productive when recruiting individuals of similar racial/ethnic

4

background, and female recruiters are more productive than male recruiters when recruiting females. But using the number of contracts signed, as the measurement of productivity does not provide any clarity in terms of the quality of contracts. In particular, the AFQT scores and educational qualification of the recruits at the point of enlistment and the length of service that the recruits stayed during the first term. Those measurements are better indicator of whether capable and suitable applicants are selected by the recruiters as compared to only looking at the number of contracts signed.

Dertouzos et al. (2006) examine the determinants on the recruiters' productivity (in terms of total number of contracts and number of quality contracts) by looking at a list of factors such as recruiter characteristics and market characteristics to determine the impact of each factor on the enlistment outcome. Their findings show that the effect of gender and racial/ethnic interactions between the recruiters and recruits does affect the enlistment outcome, but the relationships are complex. Their results show that well-educated recruiters do not perform better than others in an area with relatively high rates of college attendance. Also, Hispanic recruiters do not enlist more recruits in total as well as in the number of quality recruits in Hispanic-dominated communities. African-American recruiters, while recruiting fewer high-quality recruits, outperform their cohorts in markets with a relatively high Black population. Female recruiters, while not as successful in recruiting males, generally recruit more female recruits than male recruiters.

Both Barfield (1993) and Dertouzos et al. (2006) look at the productivity of recruiters in terms of the number of contracts signed per month and number of high-quality contracts signed. While Barfield (1993) uses the number of contracts signed within a specific period of time to provide a good indication of a recruiter's productivity, the study does not allow us to understand whether this interaction effect has an impact on the quality of recruits enlisted. Dertouzos et al. (2006) goes a step further and differentiates the results by the total number of contracts and total number of high-quality contracts. This measurement is similar to looking at the quality of recruits in terms of their AFQT scores and education qualifications at the point of enlistment. These findings allow us to determine whether there is an improvement in the quality of recruits. But,

this is only reflective of the recruit's quality at the point of enlistment. Upon enlistment, the attrition rate and the point when attrition happens will be a better gauge of the quality and suitability of the recruits for the military service. Therefore, advancing the two prior studies, this research will measure the impact specifically on the quality of recruits arising from the gender and racial/ethnic interaction effect between the recruiters and recruits. The definition of quality of recruits in this study refers to the AFQT scores and classification of Category A at the point of enlistment and probability of attrition at four specific points in service during the first term of the recruits.

As there are limited studies done on the gender or racial/ethnic interaction effect between the recruiters and recruits and whether these effects could have an impact on the quality of recruits, we have considered relevant studies done in external organizations to gain a better understanding of whether such interaction effects are valid.

One applicable study is the analysis of the characteristics of teachers and students and how these interactions affect the performance of students. The rationale behind using this research is not only because of the similar area of research on the gender and racial/ethnic interaction effect, but also there is similarity in the relationship between teachers and students and that of the recruiters and recruits. For example, recruiters will have an influential role in the selection of the specialization that the applicant can consider. This can affect the applicant's decision to join the service, as the recommendation of the specialization may not be the one that the applicant originally wanted. From this relationship, we can see that the recruiter is one of the first representatives of the Navy that the potential recruit comes in contact with and the primary point of contact to approach for information and advice regarding the military career. But the recruiters do not have any immediate influence or power over whether the applicants can be enlisted, as there are selection criteria and recruitment guidelines set by the NRC. This relationship is similar to that of the teacher and student where the teacher helps the student in their learning and is the primary source of content and knowledge. But the teacher has no direct impact on whether the student can enter the next higher education institution, as that is dependent on the student's performance in the classes he takes and the results from the standardized tests.

Based on social sciences literature, there are noticeable impacts based on the relationship between teachers and students. Minority students are more likely to do better academically when matched with teachers of their own race/ethnicity. Dee (2004) finds that there are educational benefits to the students from the assignment of own-race teachers. Similarly, Dee (2005) finds that there is statistical evidence suggesting that assignment of a demographically similar teacher influences the teacher's subjective evaluations of student behavior and performance. The Dee (2004) findings are consistent with those of Barfield (1993) in terms of the higher productivity level of recruiters when recruiting individuals of similar race/ethnicity, although this is not the case for gender. Furthermore the Dee (2005) findings suggest that there is value in assigning recruiters to demographically similar recruiting areas.

E.   ORGANIZATION OF STUDY

This thesis is composed of five chapters. Chapter I provides background on the purpose of this thesis and the current studies done on recruiters' productivity. In addition, this chapter discusses the relevant studies referenced for the study of the demographic impact of recruiters on recruits. Chapter II describes the data. Chapter III describes the hypotheses for this study on the recruiter and recruit match, the analytical methodology, and discusses the possible effect of the independent variables on the dependent variables used in the methodology. The results are presented in Chapter IV, and Chapter V presents the conclusions, study limitations, and recommendations.

THIS PAGE INTENTIONALLY LEFT BLANK

II. DATA

A. DATA SOURCES

The data used for this study are from the U.S. Navy's Personalized Recruiting for Immediate and Delayed Enlistment (PRIDE) recruitment database and the Defense Manpower Data Center (DMDC). These two sources provide the personal information of Navy enlistees and their recruiters as well as the career outcomes of the recruits. The PRIDE data contains the universe of contracts signed by the Navy recruits from October 1997 to April 2011 while the DMDC data provides the personnel date of each observation captured in the PRIDE data.

1. Personalized Recruiting for Immediate and Delayed Enlistment (PRIDE)

The PRIDE database is used to determine the quality of recruits enlisted by the recruiters and to analyze the interaction effects. The gender and race/ethnicity variables are retrieved to analyze any potential interaction effect between the recruiters and recruits. The AFQT scores and education qualification of the recruiters and recruits are also used to identify the quality of the recruits at the point of enlistment. Lastly, variables are also created to describe whether the recruits left the service during DEP as well as the identification code of the recruiter and state in which the contract was signed to facilitate the analysis.

2. Defense Manpower Data Center (DMDC)

The DMDC is the human resources information source for the Department of Defense (DoD). For this study personnel data provided by the DMDC, including the recruits' career progression, date of separation and reasons for separation, were merged with the PRIDE database. From this data, attrition variables were created at four specific points in the career stage: during DEP, within the first 12 months of service, 13 months to 24 months of service (conditional on staying through the first 12 months) and 25 months to 45 months (conditional on staying through the first 24 months). These are the dependent variables used to measure the quality of recruits upon enlistment. For

measurement of quality of recruits at the point of enlistment, the AFQT scores and educational qualification variables are used as mentioned under the PRIDE data section.

The combination of the two data sources is used to analyze the interaction effect between the recruiters and recruits in terms of the gender and race/ethnicity and how these interactions affect the quality of recruits.

B.   DATA SELECTION

From the 732,193 recruits (observations) in the PRIDE database, we excluded recruits who enlisted in the year before the end of data, from May 2010 to April 2011, as they do not have sufficient length of service to determine whether they have entered the Navy or were separated from the Navy during DEP. Next, recruiters who did not have their race/ethnicity recorded are removed. For the racial/ethnic variables, some observations are placed under two categories for recruits who are enlisted from 2003 onwards. Thus, the data were aligned in accordance with the new racial/ethnic classification.

Table 1 contains the summary statistics of the selected sample of recruiters and recruits. For the recruiters, 92 percent are male; 61 percent are White, 24 percent are Black and 11 percent are Hispanic. For the recruits, 80 percent are male; 52 percent are White, 19 percent are Black, and 18 percent are Hispanic.

	Obs	Mean	Cum Percent
Demographics of Recruiters			
Male	13,813	0.923	92%
Female	1,151	0.077	100%
White	9,046	0.605	60%
Black	3,520	0.235	84%
Hispanic	1,571	0.105	94%
Asian	11	0.001	95%
Other race	816	0.055	100%
Observations	14,964		
Demographics of Recruits			
Male	435,997	0.803	80%
Female	106,885	0.197	100%
White	284,480	0.524	52%
Black	101,505	0.187	71%
Hispanic	98,091	0.181	89%
Asian	13,141	0.024	92%
Other race	45,665	0.084	100%
Observations	542,882		

Notes:
(1) Sample includes all Navy recruiting contracts signed between FY1997 and FY2010.

Table 1.   Summary statistics of the recruiters and recruits.

C.   MEASURE OF RECRUIT QUALITY AND MATCH

For this study, six dependent variables were used to measure the quality of recruits. The quality of a recruit could be determined based on the ability of the recruits as well as the suitability of the recruits for the military career. Therefore, two groups of dependent variables are used, where one group is to measure their abilities at the point of enlistment while the other group is to measure their abilities in terms of performing in their military role. Tables 2 and 3 contain the summary statistics of the six dependent variables, and the discussion about them follows.

	All recruits		Male recruits		Female recruits	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Outcomes						
AFQT percentile	60.58	18.45	61.05	18.71	58.64	17.24
High school graduate	0.93	0.25	0.92	0.27	0.97	0.17
Category A	0.68	0.47	0.69	0.46	0.67	0.47
Observations	542,882		435,997		106,885	
Attrited from DEP	0.21	0.40	0.19	0.39	0.28	0.45
Observations	542,002		435,317		106,685	
Attrited from active duty:						
within 12 months	0.19	0.39	0.18	0.39	0.23	0.42
Observations	445,670		366,209		79,461	
between 13 and 24 months	0.08	0.27	0.08	0.27	0.07	0.26
Observations	357,178		296,796		60,382	
between 25 and 45 months	0.11	0.31	0.11	0.31	0.12	0.32
Observations	300,763		250,327		50,436	

Table 2.   Summary statistics of the dependent variables by gender of recruits.

	White recruits		Black recruits		Hispanic recruits	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Outcomes						
AFQT percentile	63.88	18.44	51.14	15.80	58.69	17.65
High school graduate	0.92	0.27	0.96	0.20	0.93	0.25
Category A	0.75	0.43	0.47	0.50	0.66	0.47
Observations	284,480		101,505		98,091	
Attrited from DEP	0.20	0.40	0.21	0.41	0.21	0.40
Observations	284,043		101,348		97,920	
Attrited from active duty:						
within 12 months	0.20	0.40	0.19	0.39	0.16	0.37
Observations	234,082		83,527		80,396	
between 13 and 24 months	0.08	0.27	0.09	0.28	0.06	0.24
Observations	184,830		67,524		66,864	
between 25 and 45 months	0.11	0.31	0.13	0.33	0.09	0.29
Observations	157,098		57,539		56,231	

Table 3.   Summary statistics of the dependent variables by race/ethnicity of recruits.

1. AFQT Score and Category A Status

The first two dependent variables are proxy variables to measure the abilities of the recruits at the point of enlistment: AFQT score and whether the recruit is classified as a Category A recruit. These two variables serve as an indicator of the quality of the recruits at the point of enlistment as most of them do not have any prior working experience in the military or have just graduated from high school.

The AFQT score of a recruit is determined using four Armed Services Vocational Aptitude Basis (ASVAB) subtests: Paragraph Comprehension, Word Knowledge, Mathematics Knowledge, and Arithmetic Reasoning. These four subtests can be seen as heavily dependent on the education qualifications of a recruit, as critical thinking, mathematics skills and writing skills taught in school have a direct impact on how well the recruit will fare in the four ASVAB subtests listed above. Table 2 shows that the mean AFQT score among the recruits enlisted between FY 1997 to FY 2010 is 61 points. Less than 1 percent of the population of recruits has 30 points or fewer, which could be the minimum cut-off points that the Navy uses for recruitment.

The Navy defines a high-quality recruit as someone who meets the following two criteria: (1) has a high school diploma or is in high school and expected to earn a diploma (classified as Education Tier 1); and (2) has an AFQT score of 50 or higher. An indicator variable (Category A) is created to capture this group of high-quality recruits. As 93 percent of the recruits were under Education Tier 1 it is clear that the education qualification is a focus in Navy recruiting, and 68 percent of the recruits fall under Category A classification. The two criteria used to define Category A recruits can be seen as an indicator of the mental ability and capability of the individual. These criteria can also be used to decide for which service and specialization the recruit is suitable. The need for more Category A recruits is understandable due to the complexity arising from the operation of equipment amidst rapid technological advancement.

2. Attrition Rate

Upon enlistment, the most appropriate measurement for the quality of recruits will be the likelihood of attriting from service as it reflects how well the recruits can adapt to

the military environment and training as well as meet the job requirements. The first variable is the DEP attrition that measures whether the recruit dropped out during DEP or shipped off to boot camp. From the selected sample, 21 percent of the recruits attrited from DEP.

The remaining dependent variables measure when the recruit separated from the Navy during his first term of contract. Different from DEP attrition, attrition during the first term actually results in financial losses as well as incurring opportunity cost to the Navy as resources (monetary and non-monetary including human capital) are spent on training the recruits for the military.

Three variables are created to capture specific points in time that the recruits attrite: (1) attrition within the first 12 months of service, (2) attrition during 13 months to 24 months of service, conditional on staying through the first 12 months, and lastly, (3) attrition during the 25 months to 45 months of service, conditional on staying through the first 24 months. The 45-month mark is used even though the first term of contract is usually 48 months because the recruit can often leave the service and be considered as having fulfilled his obligation as long as he serves a minimum of 45 months.

Attrition is highest in the first year (12 months) at 19 percent, followed by attrition in the final two years (25 months to 45 months) at 11 percent and lastly, attrition in the second year (13 months to 24 months) at 8 percent.

III.   RECRUITERS-RECRUITS MATCH

A.   HYPOTHESIS ON THE INTERACTION EFFECT OF RECRUITER-RECRUIT MATCH

While most of the studies done so far on recruiters' productivity primarily focus on the effectiveness of the award system, there are two past studies that examined the gender and racial/ethnic interaction effects on the recruiters' productivity, namely Barfield (1993) and Dertouzos et al. (2006).

Given that only two studies focus on the gender and racial/ethnic interaction effect, studies done outside the setting of the military organization are used as a proxy. The studies that are relevant to this thesis are the ones done on the characteristics of teachers and how these interactions of the gender and racial/ethnic characteristics affect the performance of students. This is applicable to our study as the relationship between the teacher and student is akin to the one between recruiters and the recruits that they enlisted. This is because the recruiters are Navy representative and the primary contacts that the potential recruits approach for information about the military career and culture in general. They guide the potential recruits in terms of the specialization to consider based on their AFQT score and education qualification. Therefore, in many ways, the recruiters are like teachers to the potential recruits.

This study seeks to determine the effect arising from the gender and racial/ethnic interaction between the recruiters and the recruits. The quality of recruits enlisted is expected to improve if the recruiters and recruits share the same gender or same race/ethnicity. This assumption arises from the role-model effect (Dee, 2005) in which the presence of a demographically similar recruiter may raise an applicant's motivation and expectations to join the Navy, especially if the recruiter is a successful role model. Another possible effect is the active effect (Ferguson, 1998) that could influence the recruiter's decision to pursue an applicant to sign the contract. This arises from the unintended biases in the recruiter's prior experiences and his interactions with applicants from a different demographic background during the recruitment process.

In this study, the aim is to test the hypothesis of whether an improvement in the quality of recruits will result when there is a recruiter and recruit match in gender or race/ethnicity. Therefore, this study examines the outcome from four possible interaction effects between the recruiters and recruits: (1) same gender effect, (2) different gender effect, (3) same racial/ethnic effect and (4) different racial/ethnic effect.

B.   METHODOLOGY

The key independent variables used to examine the effect on the quality of recruits are the gender and race/ethnicity of the recruiters and recruits. To determine the effect, the coefficient estimate of the same gender or same racial/ethnic variable is derived using an ordinary least square (OLS) regression model. The analysis is done on the whole population of recruits to determine the relationship, with the exception of recruiters and recruits in the Asian and Other race categories as the findings may not be significant since as they currently constitute less than 10 percent of the total population.

Based on the hypothesized theory that the quality of recruits will improve if they share the same race/ethnicity or gender as the recruiters, the independent variables are expected to have a positive effect on the AFQT score or probability of being a Category A recruit and a negative effect on the probability of attrition.

Simple descriptive statistics are first done to determine whether there is any noticeable trend between the recruiters and recruits within each gender sub-group and racial/ethnic sub-group. Next, kernel density estimates are used to provide a visual breakdown on which race/ethnicity of recruiters performs better in enlisting different quality (in terms of AFQT scores) recruits of each gender or race/ethnicity. Two-sample Kolmogorov-Smirnov tests are used to test the equality of the distributions between each sub-group. Next, OLS regression is used to estimate the effect of gender interaction and racial/ethnic interaction arising from the recruiter-recruit match on the quality of recruits. From the regression model, we dissect the data set into the respective gender sub-groups and the respective racial/ethnic sub-groups to determine the validity of the interaction effect arising from gender and race/ethnicity, respectively. Lastly, paired sample t-tests are used to determine if there is any statistical difference between each sub-group.

16

C. HYPOTHESIZED EFFECT OF THE INDEPENDENT VARIABLES ON QUALITY OF RECRUITS

As the purpose of the study is to examine whether the gender or racial/ethnic interaction between the recruiters and recruits has a positive impact on the quality of recruits, we need to ensure that the demographic attributes of the recruiters used in the regression model capture the potential effect of the gender or racial/ethnic interaction on the quality of recruits. The six dependent variables used to define the quality of recruits are as follows: AFQT scores, Category A classification, DEP attrition, attrition during the first 12 months, attrition during 13 months to 24 months (conditional on staying through the first 12 months) and attrition during 25 months to 45 months (conditional on staying through the first 24 months). The discussion on each dependent variable follows.

1. AFQT Scores and Category A Classification

AFQT scores and education qualifications are the usual proxy variables used to identify the quality of the recruits. But the recruiters do not have a direct impact on the recruits' AFQT scores or education qualification. The education qualification of a recruit is usually dependent on his own innate ability, financial support from parents, the area he stayed in, etc. Therefore, we need to be careful not to misinterpret the effect arising from the interaction as it may be due to reverse causality.

Another issue about using AFQT scores or Category A classification is that the data set of recruits is not random. It only consists of the AFQT scores and education qualification of the selected recruits and excludes those who are rejected or others who may have similar ability but choose not to join the Navy. Thus, there may be selection bias since only those who have a preference for a military career will apply for the military service and be captured in the data set.

Thus, using AFQT score and education qualification of recruits as the dependent variables and analyzing the effect of the gender or race/ethnicity of the recruiters on the quality of recruits may not be a true measurement of the interaction effect.

2. DEP Attrition

When the recruits are put into the DEP, the recruiters will constantly keep in touch with the recruits to ensure that they complete their academic studies, if applicable, as well as stay out of trouble that can disqualify them for enlistment. The recruiters also serve as a motivator to ensure that the interest of the recruits stay strong until they are sent to boot camp.

The environment can still influence the recruits; the recruiters have a significant impact on whether the recruits will go to boot camp if they constantly monitor the recruits. If all the recruiters take on the motivator and mentor role, the effect of the recruiters on DEP attrition will give a good measurement of the gender and racial/ethnic effect arising from the interaction between the recruiters and recruits.

3. Attrition during the First 12 Months

During the first 12 months, the recruits are spending the bulk of that time undergoing training such as boot camp and specialization training. Therefore, the first 12-month period is a good test of whether the recruit can adapt to the military environment and culture as well as meet the requirements of the military job.

Also, these trainings are standardized and consistently applied to all recruits. There will not be any wide variation in the environment and training given to the recruits of the same cohort and/or specialization as these are conducted in training institutions. While the recruiters have no impact on the training that the recruits are going through, they play a crucial role in the selection and enlistment of these recruits who are assessed suitable for the military career. Thus, this dependent variable measures the quality of the recruits in terms of suitability and is primarily caused by the selection of the recruiters.

4. Attrition after the First 12 Months

For the two dependent variables for attrition beyond the first 12 months (at the 24-month and 45-month mark), the independent variable of gender or race/ethnicity of the recruiters may not be the only causal effect that influences the probability of attrition. At that point in service, there are other external factors that could influence a recruit's

decision to leave such as length or nature or number of deployment, work environment, culture of the unit, relationship with management and colleagues. This would result in omitted variable bias, and some of the intrinsic factors such as work environment or culture of unit are difficult to control for in the regression model. Also, these additional factors are not within the control of the recruiters and may affect the true estimation of the interaction effect that we hope to measure.

From the discussions about the six dependent variables, attrition during the first year is the better measurement of how the gender or racial/ethnic interaction has an impact on the quality of recruits. This study uses these variables to test our hypothesis about the recruiter and recruit match.

THIS PAGE INTENTIONALLY LEFT BLANK

IV. RESULTS

A.   DESCRIPTIVE ANALYSIS

In the previous chapter, six dependent variables were examined. These variables are used to test the hypothesis about recruiter and recruit match. Table 4 shows the breakdown of the gender of recruits within the male recruiters and female recruiters. Male recruiters have a major share of the recruits enlisted by them, getting 81 percent of the male recruits and 76 percent of the female recruits. This is understandable as male recruiters form 92 percent of the total recruiter population (see Table 1). From the results of Table 4, it suggests that there is a small positive gender interaction effect for the male recruiters on the male recruits but the effect is reverse for the female recruiters on the female recruits.

	Male recruits	Female recruits	Total
Male recruiters	0.81	0.19	0.93
Female recruiters	0.76	0.24	0.07
Total	0.80	0.20	1.00

Table 4.   Breakdown of proportion of recruits under each gender of recruiters.

The breakdown of the racial/ethnic profile of the recruits under each race/ethnicity of recruiters is shown in Table 5. The results show that White recruiters enlisted the highest proportion of White recruits at 65 percent. For the Black recruits, the Black recruiters enlisted the highest proportion of them at 42 percent. For the Hispanic recruits, the Hispanic recruiters enlisted the highest proportion of them at 41 percent. It shows recruiters are doing best in enlisting recruits from their own race/ethnicity. The results in Table 5 suggest that there is the possibility of a positive racial/ethnic interaction effect when there is a match between the recruiters and recruits.

	White recruits	Black recruits	Hispanic recruits
White recruiters	0.65	0.10	0.13
Black recruiters	0.36	0.42	0.14
Hispanic recruiters	0.35	0.14	0.41
Total	0.52	0.19	0.18

Table 5.   Breakdown of proportion of recruits under each race/ethnicity of recruiters.

The results do seem to suggest that the same gender or racial/ethnic interaction effect would improve recruitment across the board, with the exception for female recruiters with female recruits.

B.   GENDER INTERACTION EFFECT

Kernel density estimate graphs are plotted for the male and female recruits to compare the quality of recruits (in terms of AFQT scores) enlisted by different gender of recruiters. Overall, the kernel density estimate graph for male recruits (see Figure 1) shows very little difference in the distribution of AFQT scores, despite the fact that a Kolmogorov-Smirnov test of the equality of the distributions shows they are significantly different at the one percent level, a results which is partially stemming from the large sample size.
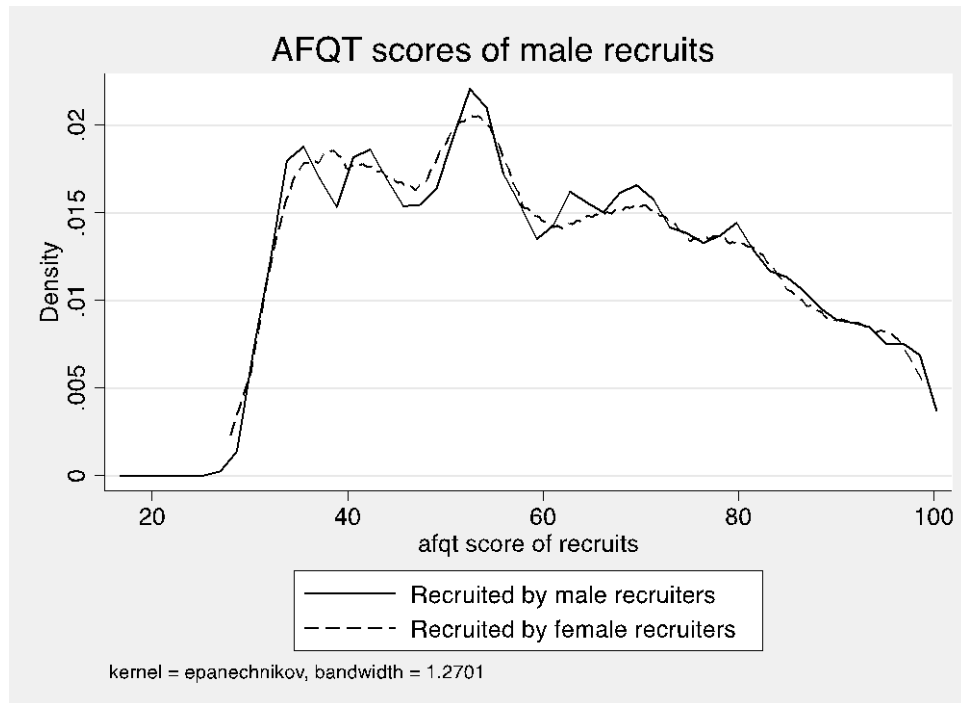
Figure 1.   Comparison of the kernel density estimate graphs between the AFQT scores of male recruits enlisted by male recruiters versus female recruiters.

For the female recruits, the graph (see Figure 2) shows similar outcome as Figure 1 as the female recruiters enlisted higher proportion of recruits with AFQT score at certain range such as 40 to 50 but the difference in AFQT score of recruits enlisted by male and female recruiters are minimal too and follow a similar distribution (again, this conclusion holds despite the fact that a Kolmogorov-Smirnov test of the equality of the distributions shows they are significantly different at the two percent level). Overall, the difference in the AFQT score of the recruits that each gender of recruiters enlisted seems to be minimal as both graphs share the same trending with occasional spikes at certain AFQT scores of recruits under Figure 1 and 2. This can be a reflection of how the coefficient estimates under Table 6 and 7 between male and female recruiters are differentiated by less than 1 point (0.20 for male recruits and 0.31 for female recruits).
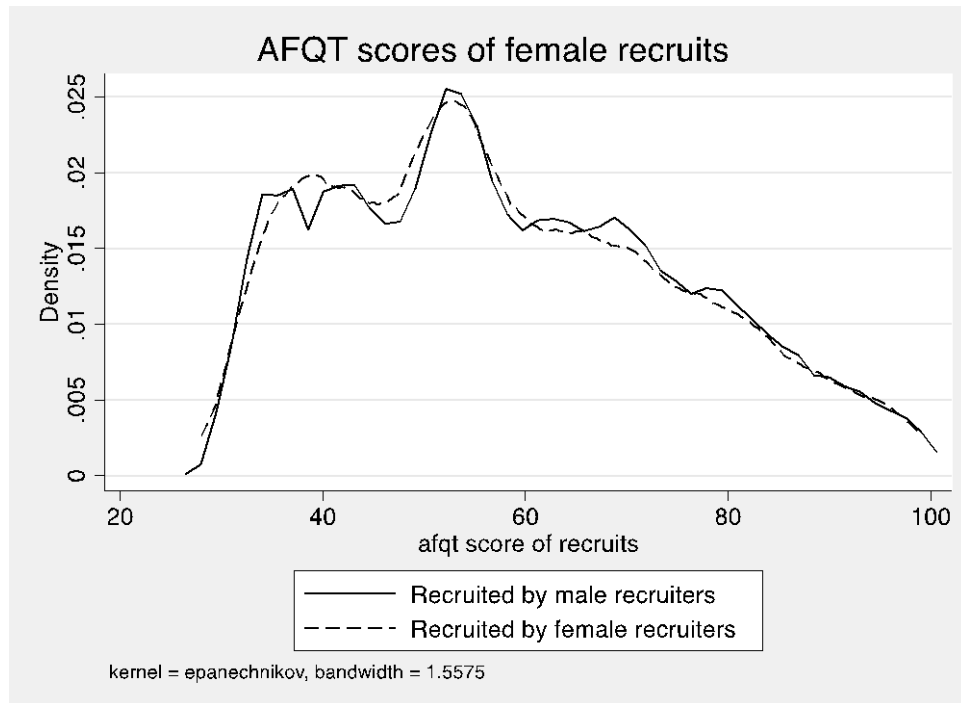
Figure 2.   Comparison of the kernel density estimate graphs between the AFQT scores of female recruits enlisted by male recruiters versus female recruiters.

Next, we estimate an OLS regression for each of the six dependent variables and differentiate it by the gender of recruit against the gender of recruiters as the explanatory variables to estimate the effect of the explanatory variables on the dependent variable. The OLS regression allows us to determine the significance of the effect of each dependent variable on the quality of recruit and to test whether there are statistical differences between the gender of recruiters. Please refer to the Appendix for the number of observations under each dependent variable that are used in the OLS regression analysis.

Table 6 shows the mean AFQT scores and the standard deviation for the recruits enlisted by each gender of recruiters. It shows that male recruiters enlisted more recruits than female recruiters and this can is a reflection of the results in Table 4 that shows that male recruiters enlisted more than 90 percent of male and female recruit population.

Table 7 shows the coefficient estimate of the AFQT scores and the standard error as well as the p-value from the paired sample t-tests done to determine whether the

coefficient estimate for each gender of recruiters is statistically different. The results show that male recruiters enlisted recruits with higher AFQT scores than female recruiters and paired sample t-test showed that this difference is statistically significant (at 10 percent significance level) for both genders of recruits. The p-value of the paired sample t-test for the male recruits is 0.09 and for the female recruits is 0.11. This shows that the difference in quality of recruits is statistically weaker for female recruits as compared to male recruits.

	Male recruits		Female recruits	
	Mean	Std. Dev.	Mean	Std. Dev.
Male recruiters	61.06	18.70	58.67	17.24
Female recruiters	60.86	18.76	58.36	17.20

Table 6. AFQT scores of recruits by different gender categories.

	Dependent Variable = AFQT scores of recruits			
	Male recruits (N = 435,997)		Female recruits (N = 106,885)	
	Coeff. Est.	Std. Error	Coeff. Est.	Std. Error
Male recruiters	61.06	0.03	58.67	0.06
Female recruiters	60.86	0.11	58.36	0.18
P-value	0.09		0.11	

Table 7. Regression analysis of the mean AFQT of recruits with p-value from paired sample t-tests.

Table 8 shows the probability of being Category A recruit and the standard deviation for the recruits enlisted by each gender of recruiters while Table 9 shows the coefficient estimate of the dependent variable and the standard error as well as the p-value from the paired sample t-tests done to determine whether the coefficient estimate for each gender of recruiters is statistically different.

Table 8 and 9 show that the male recruiters enlisted male and female recruits with higher probability of being Category A than female recruiters. From Table 9, the p-values

from the paired sample t-test showed that this difference is statistically significant (at 10 percent significance level) only for the male recruits. This is consistent with our earlier findings on AFQT scores where male recruiters are better than female recruiters in enlisting recruits with higher AFQT scores.

	Male recruits		Female recruits	
	Mean	Std. Dev.	Mean	Std. Dev.
Male recruiters	0.687	0.464	0.668	0.471
Female recruiters	0.678	0.467	0.663	0.473

Table 8.   Proportion of Category A recruits by different gender categories.

	Dependent Variable = Probability of Category A recruits			
	Male recruits (N = 435,997)		Female recruits (N = 106,885)	
	Coeff. Est.	Std. Error	Coeff. Est.	Std. Error
Male recruiters	0.687	0.001	0.668	0.002
Female recruiters	0.678	0.003	0.663	0.005
P-value	0.006		0.379	

Table 9.   Regression analysis of the probability of Category A recruits with p-value from paired sample t-tests.

Tables 10 through 17 present the breakdown of the probability of attrition for recruits enlisted by male and female recruiters and the p-values from the paired sample t-tests. The lower the probability of attrition the better the quality of recruits as it shows that the recruiters enlisted recruits that are able to meet the rigors of military training and the requirements of the specialization.

For attrition variables, the coefficient estimates show that female recruiters did better in enlisting recruits with lower probability of attrition during DEP and between 13 and 24 months. Female recruiters also enlisted male recruits with lower probability of attrition during the first 12 months. For the male recruiters, they did better in enlisting

female recruits with lower probability of attrition during the first 12 months and both gender of recruits with lower probability of attrition between 25 and 45 months.

However, the paired sample t-tests show that only the coefficient estimates for female recruiters enlisted male recruits with a lower probability of attrition during the first 12 months is statistically significant at 10 percent significance level. The rest of the attrition probabilities between male and female recruiters are statistically insignificant.

	Male recruits		Female recruits	
	Mean	Std. Dev.	Mean	Std. Dev.
Male recruiters	0.188	0.390	0.278	0.448
Female recruiters	0.185	0.388	0.270	0.444

Table 10.   Probability of DEP attrition by different gender categories.

	Dependent Variable = Probability of DEP attrition			
	Male recruits (N = 435,317)		Female recruits (N = 106,685)	
	Coeff. Est.	Std. Error	Coeff. Est.	Std. Error
Male recruiters	0.188	0.001	0.278	0.001
Female recruiters	0.185	0.002	0.270	0.005
P-value	0.217		0.144	

Table 11.   Regression analysis of the probability of DEP attrition with p-value from paired sample t-tests.

	Male recruits		Female recruits	
	Mean	Std. Dev.	Mean	Std. Dev.
Male recruiters	0.183	0.386	0.233	0.423
Female recruiters	0.174	0.379	0.237	0.425

Table 12.   Probability of attrition within first 12 months by different gender categories.

	Dependent Variable = Probability of attrition within first 12 months			
	Male recruits (N = 366,209)		Female recruits (N = 79,461)	
	Coeff. Est.	Std. Error	Coeff. Est.	Std. Error
Male recruiters	0.183	0.001	0.233	0.002
Female recruiters	0.174	0.003	0.237	0.005
P-value	0.001		0.504	

Table 13.   Regression analysis of the probability of attrition within first 12 months with p-value from paired sample t-tests.

	Male recruits		Female recruits	
	Mean	Std. Dev.	Mean	Std. Dev.
Male recruiters	0.078	0.267	0.071	0.258
Female recruiters	0.076	0.265	0.066	0.249

Table 14.   Probability of attrition between 13 and 24 months (conditional on staying through 12 months) by different gender categories.

	Dependent Variable = Probability of attrition between 13 and 24 months			
	Male recruits (N = 296,796)		Female recruits (N = 60,382)	
	Coeff. Est.	Std. Error	Coeff. Est.	Std. Error
Male recruiters	0.078	0.001	0.071	0.001
Female recruiters	0.076	0.002	0.066	0.004
P-value	0.376		0.170	

Table 15.   Regression analysis of the probability of attrition between 13 and 24 months (conditional on staying through 12 months) with p-value from paired sample t-tests.

	Male recruits		Female recruits	
	Mean	Std. Dev.	Mean	Std. Dev.
Male recruiters	0.106	0.308	0.118	0.323
Female recruiters	0.110	0.313	0.119	0.324

Table 16.   Probability of attrition between 25 and 45 months (conditional on staying through 24 months) by different gender categories.

	Dependent Variable = Probability of attrition between 25 and 45 months			
	Male recruits (N = 250,327)		Female recruits (N = 50,436)	
	Coeff. Est.	Std. Error	Coeff. Est.	Std. Error
Male recruiters	0.106	0.001	0.118	0.002
Female recruiters	0.110	0.002	0.119	0.005
P-value	0.143		0.801	

Table 17.   Regression analysis of the probability of attrition between 25 and 45 months (conditional on staying through 24 months) with p-value from paired sample t-tests.

The results from the analysis on the gender interaction effect provided statistical evidence to support our hypothesis on the improvement of the quality of recruits when

there is a gender match between the recruiter and recruit at the point of recruitment. It shows that male recruiters enlisted male recruits with higher mean AFQT score and probability of being a Category A. But male recruiters also did better than female recruiters when recruiting female recruits, as the mean AFQT score of the female recruits is 0.31 higher. So, at the point of recruitment, male recruiters fare better in enlisting better quality recruits.

For attrition probability, there is no statistical evidence to support the hypotheses of improving in quality of recruits when there is a gender match. It is only statistically significant for male recruits enlisted by female recruiters as the recruits have the lower probability of attrition during the first 12 months. It may suggest that there could be other attritions to look out for at the point of recruitments on top of AFQT score and education qualification as female recruiters enlist recruits with lower AFQT score.

C. RACIAL/ETHNIC INTERACTION EFFECT

Two sample Kolmogorov-Smirnov tests are used to test if the recruits of a particular race/ethnicity, who are enlisted by two racial/ethnic groups of recruiters, have identical distribution of AFQT scores. The combined Kolmogorov-Smirnov corrected p-values are less than 0.10 except for the test on White recruits enlisted by White recruiters versus Hispanic recruiters, which is 0.45. The results show that they are significantly different at 10 percent level, with the exception of White recruits enlisted by White recruiters.

Next, kernel density estimate graphs are plotted for each racial/ethnic category of recruits to compare the quality of recruits enlisted by different race/ethnicity of recruiters. Based on the kernel density estimates graphs (see Figures 3 to 5), White recruiters enlisted higher proportion of recruits who had AFQT scores of 60 and above. As compared to White recruiters, the Black and Hispanic recruiters enlisted a higher proportion of White recruits who had AFQT scores of 80 and above. But the difference is minimal as shown by how close the graphs are for each racial/ethnic category. This is also seen in the coefficient estimates under Table 19 for each racial/ethnic category of recruits and recruiters that the difference is less than one point. Overall, there is no

consistent evidence to show that the same racial/ethnic effect would result in enlisting better quality recruits as there are little difference in the distribution of the AFQT scores.
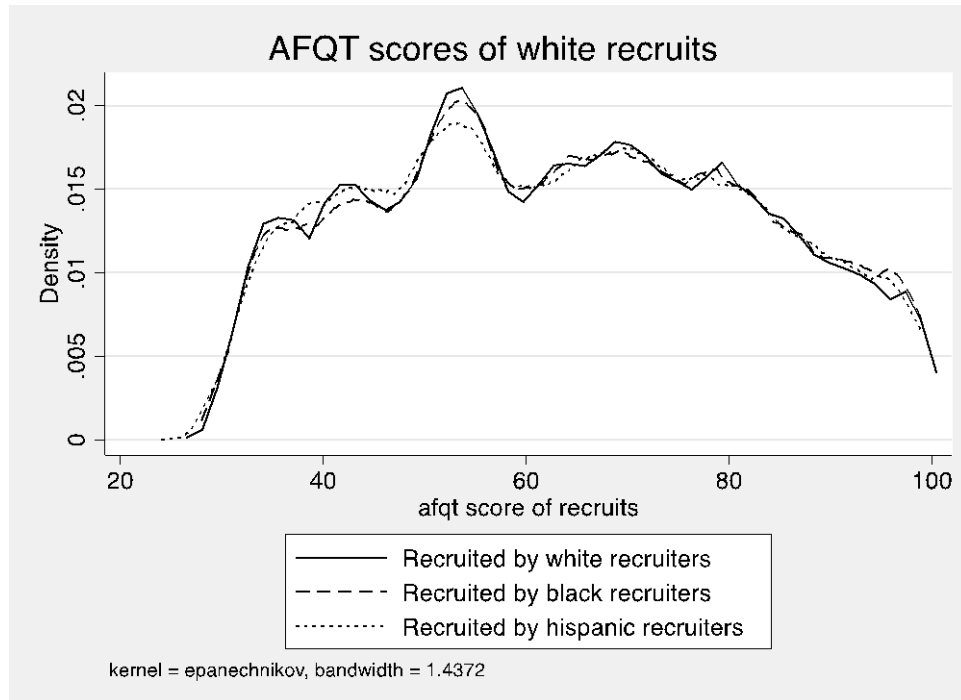
Figure 3.   Comparison of the kernel density estimate graphs between the AFQT scores of White recruits enlisted by White, Black and Hispanic recruiters.
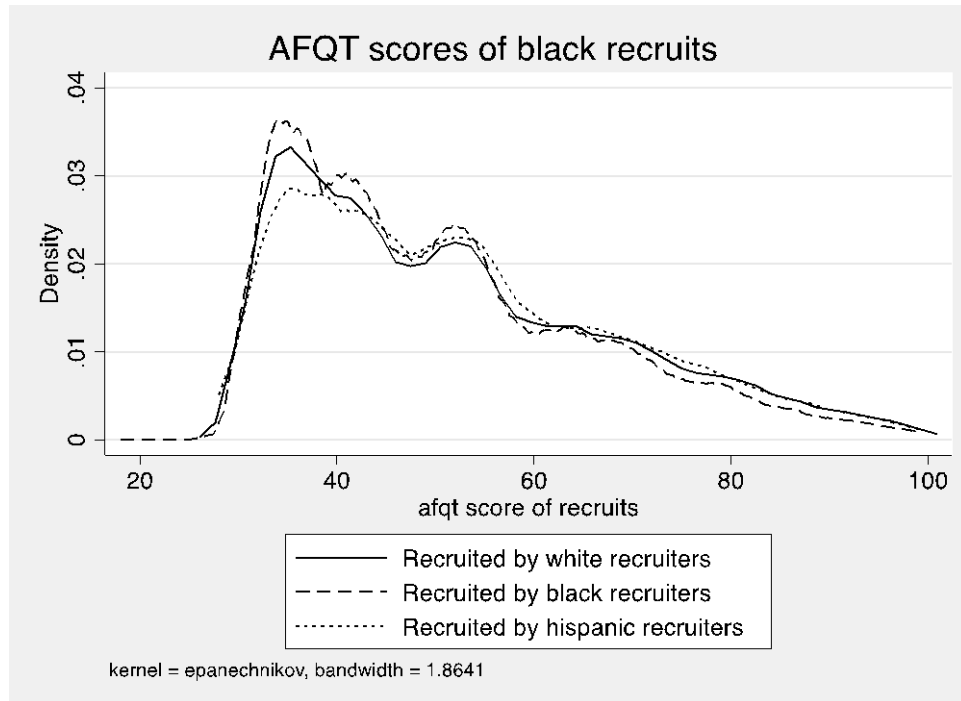
Figure 4.   Comparison of the kernel density estimate graphs between the AFQT scores of Black recruits enlisted by White, Black and Hispanic recruiters.
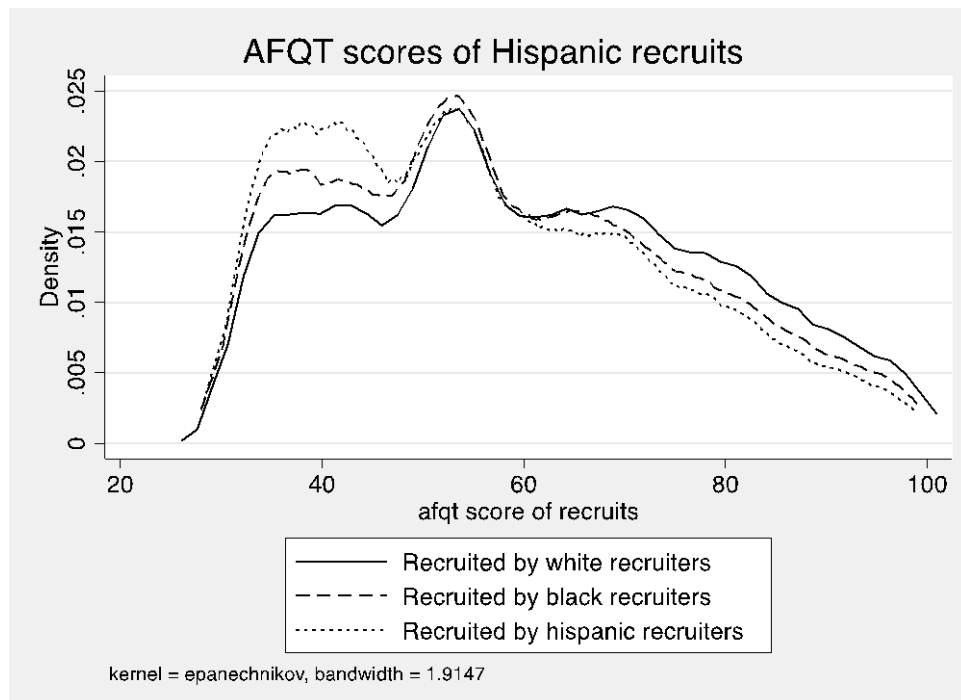
Figure 5.   Comparison of the kernel density estimate graphs between the AFQT scores of Hispanic recruits enlisted by White, Black and Hispanic recruiters.

Next, we estimate an OLS regression for each of the six dependent variables and differentiate it by the race/ethnicity of recruits against the race/ethnicity of recruiters as the explanatory variables to estimate the effect of the explanatory variables on the dependent variable. The OLS regression allows us to determine the significance of the effect of each dependent variable on the quality of recruits and to test whether there are statistical differences among the three racial/ethnic categories of the recruiters. Please refer to the Appendix for the number of observations under each dependent variable that are used in the analysis.

Table 18 shows the mean AFQT score of recruits under each racial/ethnic category and broken down into the respective racial/ethnic categories of recruiters. Table 19 shows that the difference in the quality of recruits (in terms of mean AFQT scores) enlisted by different race/ethnicity of recruiters are statistically significant for most paired sample t-tests as the p-value is less than 0.10. The exception is for the White recruits enlisted by White recruiters as compared to Hispanic recruiters and Black recruiters as compared to Hispanic recruiters as there is no statistical difference in terms of the AFQT score of White recruits. The results in Table 19 do not provide any statistical evidence to support our hypothesis that having a match in the race/ethnicity of the recruiters and recruits will result in enlisting better quality recruits. Instead, the racial/ethnic match between the recruiters and recruits resulted in a lower AFQT score.

	White recruits		Black recruits		Hispanic recruits	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
White recruiters	63.77	18.39	51.91	16.35	60.50	17.84
Black recruiters	64.17	18.55	50.41	15.37	58.23	17.38
Hispanic recruiters	63.90	18.56	52.53	16.13	56.53	17.12

Table 18.   AFQT scores of recruits by different racial/ethnic categories.

	Dependent Variable = AFQT score of recruits					
	White recruits (N = 273,360)		Black recruits (N = 97,947)		Hispanic recruits (N = 87,250)	
	Coeff. Est.	Std. Error	Coeff. Est.	Std. Error	Coeff. Est.	Std. Error
White recruiters (1)	63.77	0.05	51.91	0.11	60.50	0.13
Black recruiters (2)	64.17	0.10	50.41	0.08	58.23	0.18
Hispanic recruiters (3)	63.90	0.15	52.53	0.20	56.53	0.16
P-value						
(1) = (2)	0.00		0.00		0.00	
(1) = (3)	0.44		0.01		0.00	
(2) = (3)	0.13		0.00		0.00	

Table 19.   Regression analysis of the mean AFQT score of recruits with p-value from paired sample t-tests.

Table 20 shows that there is also no statistical evidence that the same race/ethnicity would result in a higher probability of enlisting Category A recruits. Instead, a negative effect exists for the Black recruiters and Hispanic recruiters as they have the lowest probability of enlisting Category A recruits of their own race/ethnicity. This is consistent with the findings from the analysis of the same racial/ethnic effect on the mean AFQT scores of recruits.

	White recruits		Black recruits		Hispanic recruits	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
White recruiters	0.748	0.434	0.489	0.500	0.701	0.458
Black recruiters	0.754	0.431	0.455	0.498	0.657	0.475
Hispanic recruiters	0.743	0.437	0.509	0.500	0.608	0.488

Table 20.   Proportion of Category A recruits by different racial/ethnic categories

Table 21 shows that the differences in the probability of being a Category A recruit among the different racial/ethnic category of recruiters are statistically significant (at the 10 percent significance level). This is with the exception for the White recruits enlisted by the White recruiters as compared to the Hispanic recruiters as the p-value is greater than 0.10. The positive impact on probability of Category A classification is not consistent across the board. Similar to the findings for AFQT scores, White recruiters enlisted Hispanic recruits with highest probability of being Category A, Black recruiters enlisted White recruits with the highest probability of being Category A, while Hispanic recruiters enlisted Black recruits with the highest probability of being Category A. Also, when there is a racial/ethnic match, the recruits actually have the lowest probability of being in Category A for Black and Hispanic racial/ethnic category.

	Dependent Variable = Probability of Category A recruits					
	White recruits (N = 273,360)		Black recruits (N = 97,947)		Hispanic recruits (N = 87,250)	
	Coeff. Est.	Std. Error	Coeff. Est.	Std. Error	Coeff. Est.	Std. Error
White recruiters (1)	0.748	0.001	0.489	0.003	0.701	0.003
Black recruiters (2)	0.754	0.002	0.455	0.002	0.657	0.004
Hispanic recruiters (3	0.743	0.003	0.509	0.006	0.608	0.003
P-value						
(1) = (2)	0.006		0.000		0.000	
(1) = (3)	0.128		0.001		0.000	
(2) = (3)	0.002		0.000		0.000	

Table 21.   Regression analysis of the probability of Category A recruits with p-value from paired sample t-tests.

Tables 22 to 29 show the mean and standard deviation as well as the coefficient estimates and the standard error of the probability of attrition for recruits enlisted by each racial/ethnic category of recruiters and the p-values from the paired sample t-tests done on the comparison between the coefficient estimates for different race/ethnicity of recruiters for each race/ethnicity of recruits.

For DEP attrition (see Tables 22 and 23), White recruits and Hispanic recruits have the lowest probability of attrition when White recruiters enlist them. But this is only statistically significant (at 10 percent significance level) for White recruits enlisted by the White recruiters. For Hispanic recruits, there is no statistical difference between the racial/ethnic categories of the recruiters. For the Black recruits, Hispanic recruiters enlist Black recruits with the lowest probability of DEP attrition. However, there is no significant statistical difference in the probability of DEP attrition between those enlisted by White recruiters and Hispanic recruiters. Thus, the results for Black recruits show that White recruiters and Hispanic recruiters enlist Black recruits with a lower probability of DEP attrition as compared to White recruiters.

	White recruits		Black recruits		Hispanic recruits	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
White recruiters	0.201	0.401	0.205	0.404	0.206	0.405
Black recruiters	0.207	0.405	0.212	0.408	0.211	0.408
Hispanic recruiters	0.206	0.404	0.203	0.402	0.215	0.411

Table 22.   Probability of DEP attrition by different racial/ethnic categories.

	Dependent Variable = Probability of DEP attrition					
	White recruits (N = 272,945)		Black recruits (N = 97,796)		Hispanic recruits (N = 87,095)	
	Coeff. Est.	Std. Error	Coeff. Est.	Std. Error	Coeff. Est.	Std. Error
White recruiters (1)	0.201	0.001	0.205	0.002	0.206	0.002
Black recruiters (2)	0.207	0.002	0.212	0.002	0.211	0.003
Hispanic recruiters (3)	0.206	0.003	0.203	0.004	0.215	0.003
P-value						
(1) = (2)	0.004		0.028		0.224	
(1) = (3)	0.084		0.620		0.009	
(2) = (3)	0.789		0.064		0.280	

Table 23.   Regression analysis of the probability of DEP attrition with p-value from paired sample t-tests.

For attrition during the first term of service (see Tables 24 to 29), the coefficient estimates show that the Hispanic recruiters enlisted recruits with the lowest probability of attrition within the first 12 months and in the second year for all three racial/ethnic categories of recruits, and between 25 and 45 month mark for Black recruits and Hispanic recruits. The White recruiters enlisted White recruits with the lowest probability of attrition between 25 and 45 month mark.

The results from the paired sample t-tests show that this is statistically significant (10 percent significance level) during the first 12 months for all racial/ethnic categories of recruits enlisted by Hispanic recruiters (see Table 25). In the second year (see Table 27), this is only statistically significant (10 percent significance level) for Black recruits enlisted by Hispanic recruiters. For the White recruits and Hispanic recruits, there is no particular racial/ethnic category of recruiters that did better. For the between 25 and 45 month mark (see Table 29), this is statistically significant (10 percent significance level) for Hispanic recruits enlisted by Hispanic recruiters. For the White recruits and Black recruits, there is no particular race/ethnicity of recruiters that did better.

	White recruits		Black recruits		Hispanic recruits	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
White recruiters	0.203	0.402	0.189	0.392	0.170	0.375
Black recruiters	0.209	0.407	0.189	0.391	0.165	0.371
Hispanic recruiters	0.193	0.395	0.167	0.373	0.153	0.360

Table 24. Probability of attrition within first 12 months by different racial/ethnic categories.

	Dependent Variable = Probability of attrition within first 12 months					
	White recruits (N = 224,929)		Black recruits (N = 80,583)		Hispanic recruits (N = 71,228)	
	Coeff. Est.	Std. Error	Coeff. Est.	Std. Error	Coeff. Est.	Std. Error
White recruiters (1)	0.203	0.001	0.189	0.002	0.170	0.002
Black recruiters (2)	0.209	0.002	0.189	0.002	0.165	0.003
Hispanic recruiters (3)	0.193	0.003	0.167	0.005	0.153	0.003
P-value						
(1) = (2)	0.004		0.882		0.153	
(1) = (3)	0.002		0.000		0.000	
(2) = (3)	0.000		0.000		0.003	

Table 25.   Regression analysis of the probability of attrition within first 12 months with p-value from paired sample t-tests.

	White recruits		Black recruits		Hispanic recruits	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
White recruiters	0.079	0.269	0.092	0.289	0.066	0.248
Black recruiters	0.083	0.276	0.089	0.284	0.062	0.242
Hispanic recruiters	0.075	0.264	0.077	0.266	0.060	0.237

Table 26.   Probability of attrition between 13 and 24 months (conditional on staying through 12 months) by different racial/ethnic categories.

	Dependent Variable = Probability of attrition between 13 and 24 months					
	White recruits (N = 177,532)		Black recruits (N = 65,148)		Hispanic recruits (N = 59,016)	
	Coeff. Est.	Std. Error	Coeff. Est.	Std. Error	Coeff. Est.	Std. Error
White recruiters (1)	0.079	0.001	0.092	0.002	0.066	0.001
Black recruiters (2)	0.083	0.002	0.089	0.001	0.062	0.002
Hispanic recruiters (3)	0.075	0.002	0.077	0.004	0.060	0.002
P-value						
(1) = (2)	0.015		0.178		0.156	
(1) = (3)	0.171		0.000		0.006	
(2) = (3)	0.007		0.003		0.310	

Table 27. Regression analysis of the probability of attrition between 13 and 24 months (conditional on staying through 12 months) with p-value from paired sample t-tests.

	White recruits		Black recruits		Hispanic recruits	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
White recruiters	0.107	0.309	0.127	0.333	0.096	0.295
Black recruiters	0.111	0.314	0.130	0.336	0.097	0.297
Hispanic recruiters	0.108	0.310	0.122	0.328	0.087	0.282

Table 28. Probability of attrition between 25 and 45 months (conditional on staying through 24 months) by different racial/ethnic categories.

	Dependent Variable = Probability of attrition between 25 and 45 months					
	White recruits (N = 151,109)		Black recruits (N = 55,525)		Hispanic recruits (N = 49,543)	
	Coeff. Est.	Std. Error	Coeff. Est.	Std. Error	Coeff. Est.	Std. Error
White recruiters (1)	0.107	0.001	0.127	0.003	0.096	0.002
Black recruiters (2)	0.111	0.002	0.130	0.002	0.097	0.003
Hispanic recruiters (3)	0.108	0.003	0.122	0.005	0.087	0.002
P-value						
(1) = (2)	0.079		0.422		0.756	
(1) = (3)	0.847		0.341		0.001	
(2) = (3)	0.355		0.132		0.003	

Table 29.   Regression analysis of the probability of attrition between 25 and 45 months (conditional on staying through 24 months) with p-value from paired sample t-tests.

The results arising from the analysis of the same racial/ethnic interaction effect show two particular findings that support the hypothesis on the improvement of the quality of recruits when there is a match in the race/ethnicity of the recruiter and recruit. This is for the White recruiters enlisting White recruits with the lowest probability of DEP attrition and Hispanic recruiters enlisting Hispanic recruits with the lowest probability of attrition between 25 and 45 months. At the point of recruitment, there is a negative effect on the quality of recruits when there is a racial/ethnic match as recruits has the lowest AFQT score and probability of being a Category A.

One possibility for the lack of statistical evidence to support the hypotheses of improvement in quality of recruits may be the fact that there are more racial/ethnic categories as compared to gender categories and the racial/ethnic profile distribution of the recruiters and recruits population. But the noticeable results are that Hispanic recruiters are doing better in enlisting recruits with lower probability of attrition while the negative effect on the quality of recruit when there is a match during the point of recruitment is an interesting finding too as the gender effect at the point of recruitment is positive for the male recruiters enlisting male recruits.

V. CONCLUSION

A. DISCUSSION

This thesis analyzes the gender and racial/ethnic interaction effect between recruiters and recruits to determine if there is any impact on the quality of recruits that they enlist. This is a useful study on the productivity of recruiters as it looks at the possible outcome arising from the assignment of recruiters to each recruiting station and how the gender or race/ethnicity of recruiters who handle each recruitment case could have an effect on the quality of recruits that they enlist. Since the assignment of recruiters does not incur additional expense as compared to the introduction of a new award system, having a well-planned assignment framework that takes these interaction effects into consideration is not only cost efficient but apt during times of tight defense budgets amidst the current economic situation that the U.S. government is facing.

Results from the regression models and subsequent tests to analyze the gender and racial/ethnic interaction effect did not show consistent conclusions of a positive effect on the quality of recruits as compared to our hypotheses. The usage of paired sample t-tests and two sample Kolmogorov-Smirnov tests provide clarity on whether there is any statistical difference between the gender or racial/ethnic categories, while the kernel density estimate graphs provide visual presentation of which gender or race/ethnicity of recruiters performs better for the mean AFQT scores of the recruits.

For the analysis done on the same gender effect, the results show that having a gender match could improve the AFQT scores and the probability of the recruit being a Category A. Moreover, it could lower the probability of attrition at the 25 to 45 month mark for male recruits who are enlisted by male recruiters. The gender effect on the quality of recruits becomes negative for the female recruiters. Female recruiters did better at enlisting recruits with a lower probability of attrition during DEP and at the 13 to 24 month mark, but fared better in enlisting male recruits with a lower probability of attrition during the first 12 months. Results from the paired sample t-tests, kernel density

estimate graphs and two sample Kolmogorov-Smirnov tests show that this positive improvement in the quality of recruit is not statistically significant across the board.

Possible explanations for the findings on the gender interaction effect could be that male recruiters may be following the recruitment criteria more strictly, as they enlisted recruits with higher AFQT scores and better education qualifications than the female recruiters did. Female recruiters, on the other hand, may have considered other factors, such as personality, personal aspirations, reasons for joining the military, which are secondary to the recruitment criteria set for the AFQT score and education qualification. This could be the reason behind the lower mean AFQT score of the recruits enlisted by female recruiters. Alternatively, there could also be the role-model effect in place that attracts better quality male applicants to gravitate towards the male recruiters although the assignment of recruiters by gender to recruiting zone is not part of the selection and assignment criteria.

The findings for the gender interaction effect is different from Barfield's (1993) study in which she finds that female recruiters were more productive in recruiting females as compared to male recruiters, although Barfield (1993) looks at the average number of contracts signed instead of the quality of the recruits in terms of the six dependent variables that are used in this study. But our results are consistent with Dertouzos et al. (2006) who find that female recruiters produce fewer high-quality contracts in an average month, all other things being equal. Similarly, our findings show that female recruiters enlisted female recruits with lower AFQT score.

In contrast, female recruiters are able to enlist recruits with a lower probability of attrition during first 12 months, although they enlisted recruits with lower AFQT scores as compared to male recruiters. The results may suggest that the AFQT scores and possibly, the education qualification also, could have a causal effect on the probability of attrition instead of the gender interaction between the recruiters and recruits. But, in general, female recruiters may be better at evaluating the secondary attributes of an applicant, other than AFQT scores and education qualification, to determine the applicant's suitability for the military career.

For the racial/ethnic interaction effect, there is no consistent statistical evidence to show that having a match in the race/ethnicity between the recruiters and recruits will improve the quality of recruits. Results from the paired sample t-tests, kernel density estimate graphs and two sample Kolmogorov-Smirnov tests show that the lowering of the probability of DEP attrition only applies to White recruiters and White recruits. Our analysis also shows that Hispanic recruiters are doing better are enlisting recruits with lower probability of attrition at different window period within the first term.

The analysis of the mean AFQT scores and Category A variables shows that there is no evidence of how the same racial/ethnic effect would result in better quality recruits. Instead, a match in the race/ethnicity between recruiters and recruits results in lower quality recruits in terms of AFQT scores and probability of being a Category A recruits for the Black recruiters-recruits match and the Hispanic recruiters-recruits match. This reverse effect is similar to the findings in Dertouzos et al. (2006) as Hispanic recruiters are not more productive in terms of the number of contracts signed when assigned to a predominantly Hispanic community. But one possible reason to explain Dertouzos et al. (2006) and our findings could be that the many different racial/ethnic groups within the Hispanic community itself are not captured in the analysis as we use Hispanic as a generic racial/ethnic category. The negative effect could be due to a mismatch in the race/ethnicity for which our data set does not have the additional information for analysis.

While the mean AFQT scores and probability of Category A recruits enlisted by Hispanic recruiters are lower, the Hispanic recruiters actually enlist recruits with a lower probability of attrition during the first term. Similar to the possible reason derived for the gender effect, the Hispanic recruiters may have considered other qualities of the recruits and not just the AFQT scores and education qualification. One possible reason for this finding is that the Hispanic recruiters may be stationed back in their home state where they may already know the recruits or have a clearer understanding of the qualities of recruits, as they may have the same background. But this assumption needs to be tested by controlling for their race/ethnicity within the Hispanic category as well as their home state.

The findings from our study do not support the hypotheses made on the positive impact on the quality of recruits when there is a match in the gender or race/ethnicity of the recruiters and recruits. Instead, the relationship is complex and not consistent across the gender or racial/ethnic categories. The lack of consistent statistical significance in the gender or racial/ethnic effect in enlisting better quality recruits may be due to factors that we may not have controlled for or captured in this study. There is a need to conduct further analysis with more independent variables to tease out the possible effect that may have been left out.

But the statistically significant findings arising from the interaction effects such as male recruiters on male recruits at the point of recruitment, or the negative effect from the racial/ethnic interaction effect at the point of recruitment, could be a useful reference for future assignment of recruiters. If the findings in this study about the interaction effect are valid and the Navy were able to match recruiters to recruits appropriately according to gender or race/ethnicity in all recruitment cases, the Navy could improve the retention rate and substantially reduce the waste of financial and human capital resources that it invests in the process of recruiting and training of enlistees.

B. LIMITATIONS

This thesis has several limitations. Firstly, the usage of the AFQT score and educational qualification of the recruits to define the quality of recruits could result in selection bias, as the data is limited to recruits who are enlisted. The group of applicants who are rejected and potential applicants who do not apply but could be suitable for a military career are observations that should be included to ensure that the data set is random.

Secondly, there is another form of selection bias in terms of the assignment of recruiters. The recruiters may be assigned in accordance with their gender or race/ethnicity as to achieve a better recruiting outcome, and this will have an impact on the coefficient estimates that our study derived.

Lastly, this study has not controlled for the age of recruiters and years of experience as a recruiter, which can have an influence on the recruiter's assessment of

applicants for the military career. The more experience the recruiters have, the better they should be at judging the capabilities and suitability of an applicant, in addition to the education qualification and AFQT scores.

C.   RECOMMENDATIONS

Further research can focus on using data with a combined data set of students who have participated in the ROTC program. This will widen the scope of observations and allow the sample size to be more randomized. Doing so will provide a better estimate of the interaction effect on the AFQT scores of the recruit and probability of being a Category A recruit. Also, if one is able to control for the cohort, specialization, and unit of deployment of the recruits, one can minimize the omitted variable bias in the model that uses attrition between 13 months to 24 months and attrition between 25 months to 45 months as the dependent variable. Lastly, if one is able to control for the experience of the recruiters in terms of years of service as a recruiter, this can also help to address any potential omitted variable bias in the model when it comes to the selection of applicants who are not in the Education Tier 1 or who have poor AFQT scores.

In terms of the specific group of recruiters who are enlisting better quality recruits, additional study could be done on the characteristics and ability of recruiters. Successful recruiters may have certain personalities or soft skills that enable them to interact more effectively with the potential applicants. Also, the recruiters may have certain training or experience that may help in the recruitment process. If these factors are identified and proven to be valid, the findings can serve as a useful guide for NRC in their training program for future recruiters.

D.   CONCLUSION

While there is no strong statistically significant evidence to support the hypothesized theory of better quality recruits arising from the recruiters-recruits match, the findings show that there are specific groups of recruiters that do recruit good candidates for the military career.

Male recruiters do better in enlisting better quality male recruits at the point of recruitment in terms of higher AFQT scores and probability of being Category A as compared to female recruiters. But female recruiters seem to do better at enlisting male recruits who have lower attrition probability during the first 12 months. Also, there is a negative effect on the quality of recruits when there is a racial/ethnic match at the point of recruitment. Thereafter, the more significant findings for attrition probability is that the Hispanic recruiters are better in enlisting recruits with lower attrition probability during the first 12 months. This information is a useful indicator that NRC can make use of for future selection and assignment of recruiters as it can improve the quality of recruits and lead to better usage of defense budget and human capital in the recruitment process and training of recruits.

If the findings are reflecting a causal relationship, the Navy could potentially benefit from changing the gender and racial/ethnic profile of the recruiters' community. This is because the highlighted groups of recruiters constitute a small proportion of the recruiters' population. The female recruiters only form about 8 percent of the recruiters' population while the Black and Hispanic recruiters only constitute about 34 percent of the recruiters' population.

APPENDIX. NUMBER OF OBSERVATIONS FOR EACH DEPENDENT VARIABLE

The following tables provide the number of observations under each dependent variable that are used in the analysis of the gender interaction effect and racial/ethnic interaction effect.

Dependent Variables		Number of observations	
		Male recruits	Female recruits
AFQT scores	Male recruiters	408,951	98,193
	Female recruiters	27,046	8,692
Probability of Category A	Male recruiters	408,951	98,193
	Female recruiters	27,046	8,692
Probability of DEP attrition	Male recruiters	408,300	98,012
	Female recruiters	27,017	8,673
Probability of attrition within first 12 months	Male recruiters	343,372	72,946
	Female recruiters	22,837	6,515
Probability of attrition between 13 and 24 months	Male recruiters	278,097	55,455
	Female recruiters	18,699	4,927
Probability of attrition between 25 and 45 months	Male recruiters	234,479	46,263
	Female recruiters	15,848	4,173

Table 30.   Number of observations under each dependent variable that are used in the analysis of the gender interaction effect

Dependent Variables		Number of observations		
		White recruits	Black recruits	Hispanic recruits
AFQT scores	White recruiters	202,304	30,629	41,480
	Black recruiters	49,352	58,841	19,957
	Hispanic recruiters	21,704	8,477	25,813
Probability of Category A	White recruiters	202,304	30,629	41,480
	Black recruiters	49,352	58,841	19,957
	Hispanic recruiters	21,704	8,477	25,813
Probability of DEP attrition	White recruiters	201,983	30,586	41,414
	Black recruiters	49,284	58,746	19,920
	Hispanic recruiters	21,678	8,464	25,761
Probability of attrition within first 12 months	White recruiters	166,623	25,324	33,943
	Black recruiters	40,524	48,244	16,315
	Hispanic recruiters	17,782	7,015	20,970
Probability of attrition between 13 and 24 months	White recruiters	131,521	20,412	27,923
	Black recruiters	31,793	38,937	13,502
	Hispanic recruiters	14,218	5,799	17,591
Probability of attrition between 25 and 45 months	White recruiters	112,396	17,380	23,497
	Black recruiters	26,589	33,118	11,111
	Hispanic recruiters	12,124	5,027	14,935

Table 31.   Number of observations under each dependent variable that are used in the analysis of the racial/ethnic interaction effect

48

LIST OF REFERENCES

Andrew, J. J. (2009). *Improved screening for Navy enlistment.* Doctoral dissertation, Monterey, CA: Naval Postgraduate School.

Arkes, J. & Cunha, J. M. (2013). *Workplace Goals and Output Quality: Evidence from time-constrained recruiting goals in the U.S. Navy*. White Paper, Monterey, CA: Naval Postgraduate School.

Barfield, L. C. (1993). *An analysis of enlisted Navy recruiter productivity and incentive programs, FY 1988–FY 1990*. Master's thesis, Monterey: CA, Naval Postgraduate School.

Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2006). Teacher-student matching and the assessment of teacher effectiveness. *Journal of Human Resources*, *41*(4), 778–820.

Dee, T. S. (2005). A teacher like me: Does race, ethnicity, or gender matter? *The American Economic Review*, *95*(2), 158–165.

Dee, T. S. (2004). Teachers, race, and student achievement in a randomized experiment. *Review of Economics and Statistics*, *86*(1), 195–210.

Dertouzos, J. N., & Garber, S. (2006). *Human resource management and Army recruiting: Analyses of policy options.* RAND Corporation.

Ferguson, R. F. (1998). *Teachers' perceptions and expectations and the black-white test score gap*. Washington, DC: Brookings Institution Press.

Giles, W. F., & Field, H. S. (1982). Accuracy of interviewers' perceptions of the importance of intrinsic and extrinsic job characteristics to male and female applicants. *Academy of Management Journal*, *25*(1), 148–157.

Holmes, A. L. (2013). *Analysis of the Marine Corps educational tier system*. Master's thesis, Monterey, CA: Naval Postgraduate School.

McGlocking, T. (2013). *Analysis of the U.S. Navy's goal-based awards system and its effect on recruit quality*. Master's thesis, Monterey, CA: Naval Postgraduate School.

Oken, C., & Asch, B. J. (1997). *Encouraging recruiter achievement; A recent history of military recruiter incentive programs* (No. RAND-MR-845-OSD/A). Santa Monica, CA: RAND Corporation.

Powell, G. N. (1987). The effects of sex and gender on recruitment. *Academy of Management Review*, *12*(4), 731–743.

THIS PAGE INTENTIONALLY LEFT BLANK

INITIAL DISTRIBUTION LIST

1.   Defense Technical Information Center
        Ft. Belvoir, Virginia

2.   Dudley Knox Library
        Naval Postgraduate School
        Monterey, California